NETL Life Cycle Inventory Data
Process Documentation File

Process Name:	Saline Aquifer Well Construction, Installation and Closure Assembly
Reference Flow:	1 piece of Saline Aquifer Well Construction, Installation, and Closure
Brief Description:	This unit process models the assembly of the different well types required for a saline aquifer being used for CO_2 sequestration.

Section I: Meta Data

Geographical Coverage:	United States	**Region:** United States	
Year Data Best Represents:	2009		
Process Type:	Installation Process (IP)		
Process Scope:	Gate-to-Gate Process (GG)		
Allocation Applied:	No		
Completeness:	All Relevant Flows Captured		

Flows Aggregated in Data Set:

☑ Process   ☐ Energy Use   ☐ Energy P&D   ☐ Material P&D

Relevant Output Flows Included in Data Set:

Releases to Air:	☐ Greenhouse Gases	☐ Criteria Air	☐ Other
Releases to Water:	☐ Inorganic	☐ Organic Emissions	☐ Other
Water Usage:	☐ Water Consumption	☐ Water Demand (throughput)	
Releases to Soil:	☐ Inorganic Releases	☐ Organic Releases	☐ Other

Adjustable Process Parameters:

Plume_Area	*[mi^2] Surface area of the CO2 plume in the formation*
Well_Den_Res_M	*[mi^2/well] Square miles of plume area per in-reservoir monitoring well*

Well_Den_Res_AS $[mi^2/well]$ Square miles of plume area per above seal well

Water_Prod *[dimensionless] 0 = No water production well required; 1 = water production well required*

Water_Disp *[dimensionless] 0 = No water disposal well required; 1 = water disposal well required*

Inj_Wells *[wells] Number of injection wells for the formation*

Strat_Wells *[wells] Number of strat test wells for the formation*

Tracked Input Flows:

Strat Test Well Const. and Install. *[Technosphere] Number of strat wells for the formation*

Injection Well Const. and Install. *[Technosphere] Number of injection wells for the formation*

In Reservoir Monitoring Well Const. and Install. *[Technosphere] Number of in reservoir monitoring wells for the formation*

Above Seal Monitoring Well Const. and Install. *[Technosphere] Number of above seal monitoring wells for the formation*

Groundwater Monitoring Well Const. and Install. *[Technosphere] Number of groundwater monitoring wells for the formation*

Vadose Zone Monitoring Well Const. and Install. *[Technosphere] Number of vadose zone monitoring wells for the formation*

Water Production Well Const. and Install. *[Technosphere] Number of water production wells for the formation*

Water Disposal Well Const. and Install. *[Technosphere] Number of water disposal wells for the formation*

Strat Test Well Closure *[Technosphere] Number of strat wells for the formation*

Injection Well Closure *[Technosphere] Number of injection wells for the formation*

In Reservoir Monitoring Well Closure *[Technosphere] Number of in reservoir monitoring wells for the formation*

Above Seal Monitoring Well Closure *[Technosphere] Number of above seal monitoring wells for the formation*

Groundwater Monitoring Well Closure *[Technosphere] Number of groundwater monitoring wells for the formation*

Vadose Zone Monitoring Well Closure *[Technosphere] Number of vadose zone monitoring wells for the formation*

Water Production Well Closure

[Technosphere] Number of water production wells for the formation

Water Disposal Well Closure

[Technosphere] Number of water disposal wells for the formation

Tracked Output Flows:

Saline Aquifer Well Const., Install. and Closure

[pieces] Assembly of all wells required for saline aquifer sequestration – Reference flow

---

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage3_C_Assembly_Saline_Aquifer_Well_Construction_Installation_Closure_2012.01.xls*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

This unit process provides a summary of relevant input and output flows associated with the assembly of the eight different well types required for saline aquifer sequestration of carbon dioxide (CO_2). The well types include the following: injection, stratigraphic (strat) test, in-reservoir monitoring, above seal monitoring, groundwater monitoring, vadose zone monitoring, water production, and water disposal. Well construction, installation and closure inputs and outputs are included in a separate unit processes. The reference flow of this unit process is: 1 piece of Saline Aquifer Well Construction, Installation and Closure. The relevant flows of this unit process are described below and shown in **Figure 1.** This unit process is an input to the saline aquifer sequestration operations unit process.

Boundary and Description

There are eight different well types, of varying depths, that are required for CO_2 sequestration in a saline aquifer: strat test, injection, reservoir monitoring, above seal monitoring, groundwater monitoring, vadose zone monitoring, water production, and water disposal. The NETL saline aquifer storage cost model (internal) contains a representative list of possible storage formations in the United States. For each formation, the cost model calculates the number of injection wells required and the maximum CO_2 plume surface area based on the individual geologic formation characteristics. The cost model also specifies the number and type of wells that are required. Some well types are a function of the plume area, while others are assumed to be fixed regardless of the storage formation.

Not all saline aquifers will require water production wells for pressure management. This unit process contains a switch to exclude the water production well in that case.

For cases where brine water is produced from the aquifer, there are a variety of treatment and disposal options that are possible. These options are modeled by a separate unit process. One of the options is to re-inject the brine into another suitable formation nearby. However, not all aquifers have suitable formations nearby for brine water disposal. Similar to the water production well, this unit process also contains a switch to remove the water disposal wells from the model depending on the exact scenario being modeled.

Figure 1: Unit Process Scope and Boundary
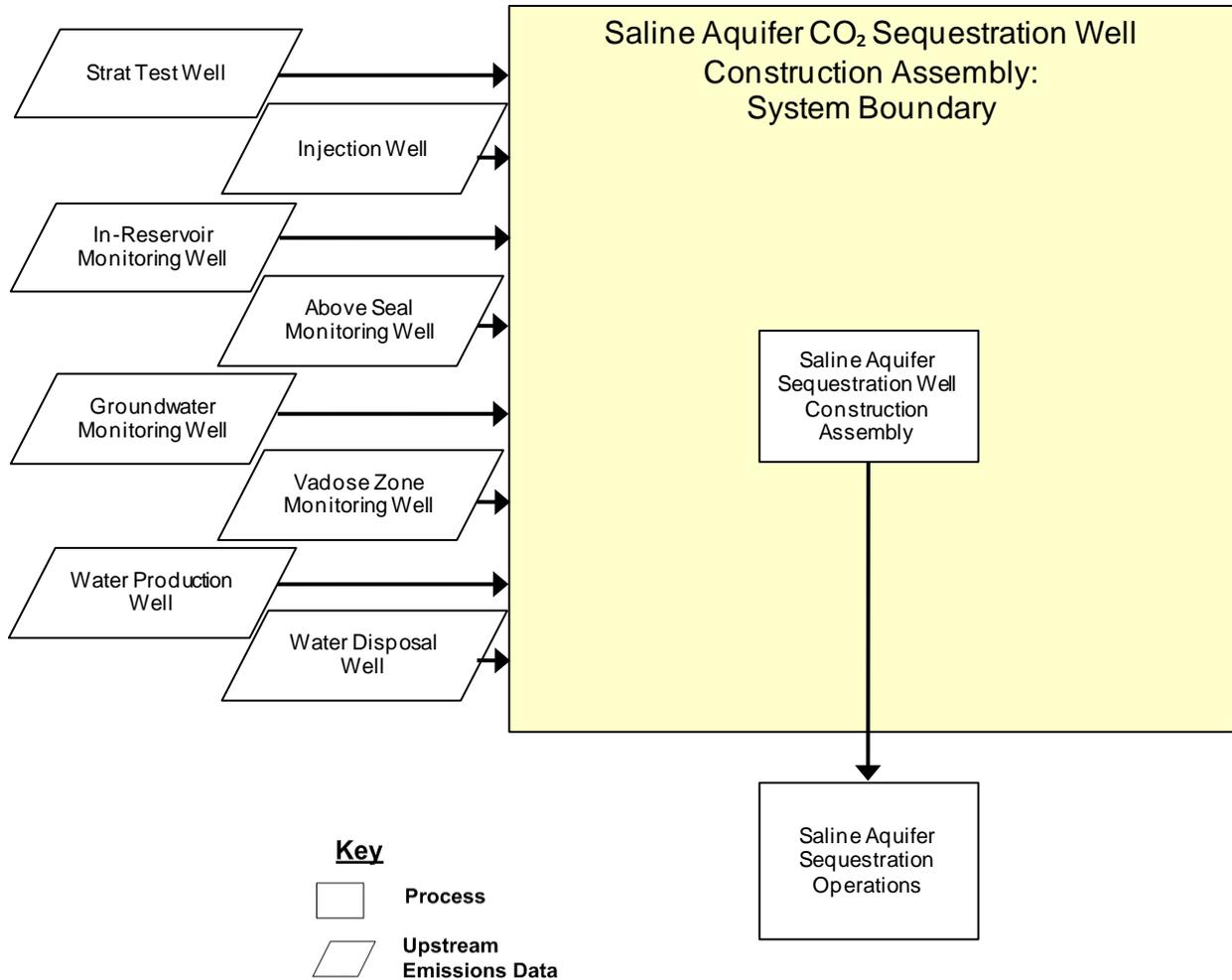
Key properties of the well construction, installation and closure assembly are summarized in **Table 1.** The inputs and outputs of this unit process are summarized in **Table 2.**

Table 1: Saline Aquifer Well Assembly – Density, Count, and Plume Area

Property	Value	Units	Source
Monitoring Wells In Reservoir	4	square miles/well	
Monitoring Wells Above Seal	2	square miles/well	
Monitoring Wells Groundwater	3	wells/Injection well	
Monitoring Wells Vadose Zone	3	wells/Injection well	
Number of Water Production	4	wells	NETL Saline Storage Cost Model
Number of Water Disposal	4	wells	
Number of Injection Wells	2	wells	
Number of Strat Test Wells	2	wells	
Plume Area (median value)	28.94	square miles	

Table 2: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Strat Test Well Construction and Installation	2.00	wells
Injection Well Construction and Installation	2.00	wells
In Reservoir Monitoring Well Construction and Installation	8.00	wells
Above Seal Monitoring Well Construction and Installation	15.00	wells
Groundwater Monitoring Well Construction and Installation	6.00	wells
Vadose Zone Monitoring Well Construction and Installation	6.00	wells
Water Production Well Construction and Installation	4.00	wells
Water Disposal Well Construction and Installation	4.00	wells
Strat Test Well Closure	2.00	wells
Injection Well Closure	2.00	wells
In Reservoir Monitoring Well Closure	8.00	wells
Above Seal Monitoring Well Closure	15.00	wells
Groundwater Monitoring Well Closure	6.00	wells
Vadose Zone Monitoring Well Closure	6.00	wells
Water Production Well Closure	4.00	wells
Water Disposal Well Closure	4.00	wells
Outputs		
Saline Aquifer Well Construction, Installation, and Closure	1.00	pieces

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows.

Embedded Unit Processes

None.

References

Section III: Document Control Information

Date Created: August 29, 2012

Point of Contact: Timothy Skone (NETL), Timothy.Skone@NETL.DOE.GOV

Revision History:

Original/no revisions

How to Cite This Document: This document should be cited as:

NETL (2012). NETL Life Cycle Inventory Data – Unit Process: Assembly, Saline Aquifer Well Construction, Installation and Closure. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: August 2012 (version 01). www.netl.doe.gov/energy-analyses (http://www.netl.doe.gov/energy-analyses)

Section IV: Disclaimer

Neither the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) nor any person acting on behalf of these organizations:

A.   Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this document, or that the use of any information, apparatus, method, or process disclosed in this document may not infringe on privately owned rights; or

B.   Assumes any liability with this report as to its use, or damages resulting from the use of any information, apparatus, method, or process disclosed in this document.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by NETL. The views and opinions of the authors expressed herein do not necessarily state or reflect those of NETL.